

## Prosthetic Socks



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"Demonstration Project on Prosthetics & Orthotics"

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## Objectives

*Upon review of this material the reader will be able to:*

- Identify five uses for prosthetic socks
- Recall sock maintenance issues
- Recall instances necessitating specially cut socks
- Recognize and recall different sock uses between trans-tibial and trans-femoral cases/applications
- Recall professionally accepted sock fitting standards
- Recall anecdotal sock thickness as it pertains to quantifying volume loss
- Recall sock measurement locations and procedures lending to the ability to appropriately select a sock per given application

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## Basic Measures

- Top
- Length
- Toe



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### Applications

- Replacing lost volume
- Interface barrier
- Additional padding
- Diagnostics
- Fabrication

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### What is a ply?

**Ply refers to the thickness of a sock**

- 1 ply
- single strand thread
- equivalent to wearing 1 sock

**2 ply (and so on...)**

- double strand thread
- equivalent of wearing 2 socks simultaneously

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### Useful Information

- **New interfaces should fit between 0 and 3 ply fit**
  - Unless otherwise specified
    - **Hard sockets** → closer to **3 ply (interface barrier)**
    - **Soft inserts or gel liners** → closer to **0 ply**

**Why?**

Because 10-12 plies of socks (2-2.4cm) is generally associated with socket replacement.

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### Useful Information

- An estimate of circumferential measurement as it relates to the number of sock ply:
  - 1 cm (10mm) is approximately 5ply or
  - 1ply is approximately 2mm

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### Why not just wear multiple socks?

- Wearing multiple socks can
  - Actually be slightly thicker than needed
  - Cause extra layers to bunch up which can
    - Cause focal loading
    - Cause discomfort
    - Example: wearing three 1plies or one 3ply
- Multiple ply socks are thinner, neater and generally more comfortable
- Generally available in the following ply
  - 1
  - 2
  - 3
  - 5
  - 6



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### Socks & Losing Volume

Volume Loss: 2 primary Mechanisms

• Edema



• Atrophy

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**Volume Loss**  
**Edema**

- In surgery, major arteries & veins are **transected** and **ligated**
- This interrupts the arteriovenous junction and flow to the lymph system
- Cutaneous and other Microcirculation is intact without a favorable method of evacuation...

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**Volume Loss**  
**Edema**

- fluid accumulates and cannot drain
- **Immediate post-op issue**
- **Daily issue**

Schematic from Marieb shows an arteriovenous junction with adjacent lymphatic vessels in normal anatomy. With an amputated limb, all of this microcirculation is eliminated. Large arteries and veins are ligated and transected. Fluid must be pumped out mechanically, through ambulation.



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**Volume Loss**  
**Atrophy**


- Note the definition of the Tibia in this patient's Right limb.
- The patient's Right limb is the more "seasoned" limb

**Considerations:**

1. Muscles artificially connected during surgery
2. No more foot, ankle, toes to function
3. Muscles no longer challenged
4. Acute and chronic problem; progressive

**Prominent areas of atrophy in the trans-tibial residuum:**

1. Anterior Muscular Compartment
2. Musculature in the Medial Tibial Flare
3. Triceps Surae
4. Muscles of the Popliteal Region
5. Quadriceps Group



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**Volume Loss**  
**Signs & Symptoms**  
**Trans-Tibial (TTA)**

- Pain/Discomfort
  - Distal end
  - Knee joint (condyles/fibula head)
  - Patella
  - Tibial Tubercle
- Evidence of "sinking" into the socket
- Confirm with
  - measurement
  - Donn a sock (or socks)

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**Volume Loss**  
**Signs & Symptoms**  
**Trans-Femoral (TFA)**

- Pain/Discomfort
  - Distal end
  - Ramus Pressure ("crotch" pressure)
  - Ischial Tuberosity Pressure
- Evidence of "sinking" into the socket
- Confirm with
  - measurement
  - Donn a sock (or socks)

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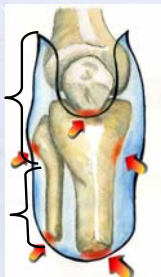
**TTA Specifics**

**TTA**

- Limb tends to be bony, proximally near the joint
  - Femoral Condyles
  - Tibial Plateau
  - Medial Tibial Flare
  - Tibial Crest
  - Tibial Tubercle
  - Fibula Head
- Tissue and Fluid are primarily distal to fibula head
- so...

Bony Region

Fleshy Region



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### Transtibial Specifics

- Adding full-length socks may, at some point, increase discomfort near the knee joint
- If symptoms do not decrease with full socks
- Try a "half sock"

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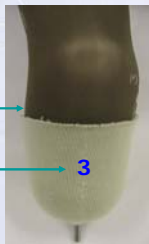
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### Half Sock

- Cut distal to Fibula Head
- Mark sock ply anterior/distal

Approximate region of Fibula Head

Once the sock is cut, there may be no way for the client to determine the sock's ply- mark the ply on the sock



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### Half Sock

- The half sock replaces volume lost distally
- This prevents "sinking" into the socket
- Does not increase thickness about the knee joint which is
  - Bony
  - mobile

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### Transtibial Amputee

- Shorter socks slide and bunch distal
- Order slightly longer than needed
- The wrinkles of a bunched sock can cause focal loading and discomfort
- Consider velcro on proximal trimlines
  - This prevents distal migration

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### Transfemoral Amputee

- Generally Cylindrical shaped with cylindrical bone
- Sinking in may be arrested by
  - Distal end
  - Ramus
  - Ischial Tuberosity
  - Watch for pain/discomfort at any/all the above



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### Transfemoral Amputation

- Order socks slightly longer than needed
- Shorter socks slide and bunch distally
  - Causing focal loading and discomfort
- Commonly, TFA socks will be rolled over/outside the socket brim
- Some patients request this initially for **skin barrier/interface barrier**

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**Interface Barrier**  
**Examples**

- Hard Sockets
- Rolling over the brim of TFA Sockets
- Liner-Liner™ Sock by Knit Rite®

Sock is rolled over the proximal trimlines to form a "gasket" softener where plastic meets skin



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**Liner-Liner™ Sock by Knit Rite®**

- This sock is made to be worn
  - Against the skin
  - Beneath a gel liner
- Typically, socks are worn over a gel liner
- Gel liners suspend via...
  - Friction
  - Suction
  - Tension
- ...against the skin so barriers tend to disrupt their suspension

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**Liner-Liner™ Sock by Knit Rite®**

- This sock is
  - Thin
  - Tight
  - Highly elastic
  - Antimicrobial
- It also has silver fibers which claim to
  - Fight bacteria
  - Fight odor



- Synthetic material blend

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### Diagnostics

- Patient taught to independently don socks
- Then follows up because home sock application was unsuccessful.
- There are many things to consider:
  - Socks donned appropriately
  - Test to see if half sock is needed
  - Distal bunching/migration
  - Losing suction (Seal-In liner®)
  - Wearing under liner?
  - Wearing three 1ply socks vs one 3ply, etc.



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### Diagnostics

Discomfort is refractory to all sock procedures:

- Look more focally at
  - The prosthesis
    - Possible adjustment
    - Alignment
  - The patient/client
    - Diet/weight loss
    - Change in medication (diuretics, anti-hypertensives)

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### Special Case

- Seal-In® Liner
- Holds distal suction with umbrella seal
- Cannot have sock over liner's seal
- Toe of sock must be cut out or air will wick past seal
- TTA, TFA, Congenital and KD



Umbrella Seal

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### Special Case

- With the Seal-In® liner, if distal volume is lost, suspension is lost
- Cannot don sock distally over liner
- For Diagnostic purposes, in the clinic,
  - sock(s) may be donned distally against skin/beneath the liner
  - to determine how much volume was lost and/or how much the socket needs to be reduced by.



Side by side comparison of full length sock and sock with toe cut out for Seal-in Liner

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### Cases where socks must be cut

- Socks for Seal-In® Liner
- Half Socks
- Hip disarticulation socks;
  - if patient chooses to wear a sock and if they want a cutout for toileting
- **Maintenance:** to remove frayed edges;
  - particularly in pin locking prostheses;
  - Frayed sock edges could result in the pin getting stuck in the lock and the client's inability to doff the prosthesis. Strands could remain in the lock rendering it unusable.

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### Maintenance

- Washing/Drying as instructed
- **Different materials** = different care
- Trimming frayed strands
  - Keeps locks and valves functioning
  - Replacing soft goods (socks/liners) annually or when recommended



Frayed ends need to be trimmed. They can jam into a pin lock or valve.



Irreparable distal sock fraying.

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### Differing Materials

- Nylon
- Wool
- Cotton
- Silver Threads
- Synthetic Blends: Lycra, Spandex
  
- Some people get very "comfortable" with certain
  - Brands
  - Length
  - Ply
  - Material

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### Fabrication

- If an interface needs to be enlarged by a given volume
  - Pulling thermoplastic over a plaster model with a given ply of sock is an alternative to...
  - ...recast/remodification
- Particularly when user is comfortable with interface contours/alignment
- Example is in the presence of weight gain

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### Fabrication



- Here, a sock is pulled over a model to enlarge the model as opposed to recasting
- Prior to pulling the new thermoplastic, a separator barrier will be needed to prevent plastic from adhering to the sock

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**Other Applications**


**Torso Socks**




**V-Neck**



**Open Toe**



**Closed Toe**



**AFO & other Foot Socks**

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**Other Applications**


**Hemi-pelvectomy and Hip Disarticulation**



**Knitted Thumb Hole**



**Thumb Knitted**



**Upper Extremity**

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**Westcoast Brace & Limb**  
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**"Demonstration Project on Prosthetics and Orthotics"**

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